METHOD FOR ADAPTING A HEARING DEVICE TO A MOMENTARY ACOUSTIC SURROUND SITUATION AND A HEARING DEVICE SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application is a Continuation-In-Part of U.S. utility patent application serial number 10/400,842 filed March 27, 2003.

FIELD OF THE INVENTION

The present invention is related to a method for adapting a hearing device, in particular a hearing aid, to a momentary acoustic surround situation, as well as to a hearing device system with a hearing device or hearing aid, respectively.

BACKGROUND OF THE INVENTION

A method and a hearing device system of this kind are known from WO-A-01/20965 or from the corresponding US-A-2002/0037087. By this known solution, the momentary acoustic surround situation is identified in the hearing device of the hearing device system, and the corresponding hearing program, i.e. the corresponding set of parameters saved in the hearing device, is automatically adjusted according to the identified acoustic surround situation. In order to provide the possibility to the hearing device user to switch off, as he wishes, the automatic recognition of the acoustic surround situation and the corresponding automatic selection of the hearing program, an input unit, e.g. a switch at the hearing device or at a remote control, is provided which can be operated by the hearing device user.

Besides that, hearing devices are also known for which the selection of the suitable hearing program can be manually made by the hearing device user from a number of hearing programs saved in the hearing device, and, to be precise, over a remote control or over a switch at the hearing device. For a lot of users, the switching between different hearing programs is however tiresome or difficult, in particular then when a lot of hearing programs are provided for selection.

The present invention has therefore the object to provide a method and a hearing device system, respectively, of the kind mentioned above, for which the hearing program corresponding to the momentary acoustic surround situation is manually or automatically adjusted, the hearing device user having the possibility to introduce his personal hearing wish optimally.

SUMMARY OF THE INVENTION

In a signal processing unit of a hearing device, the signal processing unit consisting of a signal analyzing unit and a signal identification unit, the momentary acoustic surround situation is identified. Based on this identified surround situation, the parameter set belonging to the identified surround situation is automatically adjusted in a transmission unit in which a number of parameter sets are saved which are assigned to different acoustic surround situation. In a simplified embodiment of the present

invention, a manual selection of a desired hearing program is also proposed. The hearing device user can adjust his individual hearing wish for each acoustic surround situation according to the manual or automatic adjusted parameter set with the aid of an input unit. Thereby, the parameter of this parameter set are adjusted at the same time and commonly in one of two opposing directions, e.g. in the sense of "better hearing" or in the sense of "more pleasant understanding".

The hearing device user can therefore take influence on the hearing program manually or automatically selected by the hearing device of the hearing device system, i.e. by the set of parameters corresponding to the selected hearing program, in that the hearing device user adjusts the parameters with the aid of an input unit simply operable according to predefined rules saved in the hearing device. Therewith, the hearing device user is capable to adjust the hearing program in every surround situation in an easy manner, the hearing program being adjusted to this specific surround situation and according to his personal desire, as e.g. in the sense of "better understanding" or "more pleasant hearing".

Preferably, the parameters of the adjusted parameter set are adjusted starting from an adjusted nominal value within a preset rule range according to preset rules in one of two opposing directions.

Additional features of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a block diagram of a hearing device system according to the present invention.

Fig. 2 shows an embodiment of an input unit belonging to the hearing device system according to fig. 1.

Fig. 3 shows a representation of a parameter set.

DETAILED DESCRIPTION OF THE INVENTION

The hearing device system represented in Fig. 1 as a block diagram has a hearing device 1, which consists of electro-acoustic converters, namely at least one microphone, preferably two microphones 2a, 2b as shown, as well as a receiver 3 (loudspeaker). The microphones 2a, 2b are connected to the input of a transmission unit 5 adjustable in its transmission characteristics over an analog to digital converter 4, the transmission unit 5 being connected at its output end to the receiver 3 over a digital to analog converter 6. In the transmission unit 5 a number of different sets of parameters are saved, of which

each is assigned to a certain acoustic surrounding situation and determines a transmission characteristic of the transmission unit 5. Such a parameter set 7 is schematically represented in Fig. 3. Furthermore, a signal processing unit 8 belongs to the hearing device 1, which signal processing unit 8 consists of a signal analyzing unit 9 and a signal identification unit 10 connected with the signal analyzing unit 9. The signal analyzing unit 9 is connected to the output of the analog to digital converter 4 and is fed at its input end by the input signal of the transmission unit 5. The output of the signal identification unit 10 is connected to the transmission unit 5, to which, furthermore, an input unit 11 is operationally connected. This input unit 11 consists of a remote control unit 12 separated from the hearing device for the shown implemented example, which remote control unit 12 is wirelessly connected to the hearing device 1. This remote control unit 12, only schematically represented in fig. 2, has a housing 13 in which the necessary electronic components, not further represented, are incorporated as well as two buttons 14 and 15, which are easily identifiable by the hearing device user, according to the shown embodiment by "+" (meaning e.g. "better understanding) and "-" (meaning e.g. "more pleasant hearing").

It is also possible to integrate the input unit 11 - instead of having a remote control unit 12 - into the hearing device 1 and to provide two buttons at the hearing device.

The input unit 11 can also be designed that the input is generated by the hearing device user through speech control.

The identification of the momentary acoustic surround situation and the automatic adjustment of a hearing program or set of parameters, respectively, belonging to the identified surround situation, can basically be done as has been already described in WO-A-01/20965 and US-A-2002/0037087. Therefore, reference is made to these printings for a detailed description of the automatic adjustment of the suitable hearing program, which printings are herewith incorporated by reference into this description. As a summary, the automatic hearing program adjustment is performed as follows:

In the signal analysis unit 9 characteristic, auditory-based features and, if need be, also technically-based features are extracted from the output of the analog to digital converter 4. Based on the features extracted in the signal analysis unit 9, the momentary acoustic surround situation is determined by recognition of the same or a similar pattern of the extracted features, and a corresponding signal is generated. This output signal, which contains information of the acoustic surround situation, is fed to the transmission unit 5 in which the set of parameters is adjusted determining the momentary transmission characteristic of the transmission unit 5,

which set of parameters is related to the identified acoustic surround situation.

A simplified embodiment compared to the one represented in Fig. 1 consists in that a signal processing unit 8 does not be absolutely provided, or at least in that the above-described function of the signal processing unit 8 can be put out of operation. For such a simplified embodiment of the present invention, a hearing program can be manually selected at the hearing device itself or over the remote control 12 by the hearing device user. Nevertheless, the set of parameters belonging to the selected hearing program is adjusted over the input unit according to preset rules recorded in the hearing device.

The hearing device user has also the possibility to have influence on the manually or automatically selected set of parameters as described above, i.e. on the adjusted hearing program. Thereto, the input unit 11 is used which, as already described, is operationally connected to the transmission unit 5. How this exertion of influence is taking place will be further described in the following by referring to Fig. 3.

It is assumed that the set of parameters 7 adjusted in the hearing device is shown in Fig. 3 and that this set of parameters 7 consists of the parameters P1-Pn. The nominal value adjusted for each parameter and saved in the transmission unit 5 is represented by a hatched beam and designated by N. By pushing the buttons 14, 15 the

parameters P1-Pn can be changed starting from this nominal value N going into two opposing directions C, D between two end values, which are referenced by A and B in Fig. 3 and which fix a control range. Thereby, not every one of the parameters P1-Pn can be adjusted, which would be very confusing and which would also not be handy. On the contrary, the change of the parameters P1-Pn is performed by pushing the buttons 14, 15 of the remote control unit 12 for all parameters at the same time and mutually according to predefined rules or set of rules, respectively, saved in the hearing device 1. For different acoustic surround situations, different rules or set of rules, respectively, can be applied. Thereby, every parameter of the adjusted set of parameters can be changed by a different measure, i.e. some of the parameters incur a strong change, whereas other parameters are only changed slightly or not at all. This will be further explained by referring to Fig. 3.

In a first case, one considers that the hearing device user has adjusted the parameters in direction of the arrow C by pressing the button 15 (adjusting in the sense of "more pleasant hearing"). The parameters are now adjusted to the value indicated by "X". In another case, the hearing device user has made a change of the parameters in direction of the arrow D by pressing the button 14 (adjusting in the sense of "better understanding") so that the parameters are now adjusted to the value indicated by Y. Thereby, the parameter P3 has not been changed in the represented example.

The adjustment of the parameters can be done stepwise or continuous as well as soft, i.e. not hearable, or hard, i.e. hearable.

Thanks to the method according to the present invention and by the hearing device system 1 according to the present invention, the hearing device user is capable to introduce or further introduce, respectively, his personal hearing desire, while at the same time an automatic as well as a manual selection of the hearing program best suitable to the momentary acoustic situation is taking place. This will be further clarified by an example.

The hearing device user is in a restaurant. In the background, music can be heard. At the same table, other people are sitting and are having a discussion. The hearing device is automatically or manually adjusting to this given momentary acoustic surround situation in the manner described above. The hearing device user can now have the desire to better follow up the discussions at the table, or he may want to hear the music better. In case he wants to follow the discussion better, he pushes the button 14 and adjusts the parameters P1-Pn in direction of the arrow D in the sense of "better understanding, selective hearing or more intelligibility". In case the hearing device user wants to listen to the music, he pushes the other button 15 and adjusts the parameters P1-Pn in direction of the arrow C in the sense of "more pleasant hearing or better all-around hearing, respectively".

In the hearing device, a large number of different hearing programs, i.e. the corresponding sets of parameters, can be saved. In particular for a large number of different hearing programs, the best one is automatically being selected according to the momentary acoustic surround situation. The hearing device user can convert his desire in a simple manner, namely by pressing a button of a keyboard. Thereby, the hearing desire can change from one acoustic surround situation to the next one, but also within a given acoustic surrounding. The keyboard has only two buttons, but may also have more than two buttons. As a result, the concept according to the present invention makes it possible to create a hearing device which is easily operable and which is adjusting automatically, or if necessary also manually, to a momentary acoustic surround situation and which, in addition, is taking into account the particular hearing desire of a hearing device user.

The described hearing device 1 can be designed in such a way that the corrected sets of parameters, which have been changed by the hearing device user according to his hearing desire as described above, are saved in the hearing device. In case that the hearing device user changes the assigned parameter set originally saved always and again in the same manner in a certain acoustic surround situation, i.e. always in the same direction and to the same extent, this parameter set originally saved is exchanged by the changed corrected parameter set. The corrected parameter set is then used as standard adjustment.

This exchange of the originally saved parameter set by the corrected parameter set can automatically be learnt by the hearing device, e.g. by a neural network, or by a hearing device fitter or by the hearing device user himself.

The hearing device system described above is used in the sense of a hearing aid for the correction of a hearing impairment of a person. The method according to the present invention and the hearing device concept according to the present invention can be used similarly also for other acoustic communication systems, as e.g. for radio devices. Furthermore, the present invention is in particular very useful in connection with binaural hearing aids, wherein it is conceivable to information is recorded in one of the two hearing devices or in both hearing devices. In the case where information is only recorded in one of the two hearing devices, a first embodiment consists in recording information from both hearing devices. A second, and thus a simplified embodiment consists in recording of information of only one hearing device.